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AUTHOR Kravetz, Nathan
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ABSTRACT

A summer math class for gifted girls (grades 5-9) was established and conducted by a female instructor for 3 weeks. The class involved take-home work, puzzles, problem solving, and computer work. Parents and students were satisfied with the enrichment class, but questions remained concerning such an approach's legality, the advisability of all-girl and all-boy groupings in math and some sciences, the difficulties faced by elementary teachers who are themselves math-avoiders, and the distinctions that should be made between offerings for gifted girls at various age levels. (CL)

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SINGLE-SEX CLASSES FOR GIFTED STUDENTS; A CASE REPORT

A presentation for

The California Association for the Gifted

Monterey, California February, 1984

Dr. Nathan Kravetz
Professor of Education
Coordinator of Gifted Programs
California State University
San Bernardino, California

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SINGLE-SEX CLASSES FOR GIFTED STUDENTS: A CASE REPORT

Dr. Nathan Kravetz, Professor of Education
California State University, San Bernardino

Background

In recent years attention has been called to the near absence of women in the scientific professions. Women are seldom found in those activities which require schooling in mathematics and in what have come to be known as the "hard" sciences.

We are reminded that girls in high school tend to take fewer years of mathematics courses than the boys in their classes. Thus, at the post-secondary level, girls are less ready for further work in mathematics and relevant sciences. In the array of college undergraduate majors, women are not often found in mathematics programs. To pursue this point, in none of the fields which base their development on mathematics have women received more than 30 per cent of the doctorates.

We may determine, therefore, that the absence of women in mathematics courses from the earliest years when choice is possible results in the restriction of career opportunities, the loss of equity in opportunity to participate in the broadest spectrum of professional careers, and in a negation of potential for personal fulfillment.

The loss of such expert resources in the national labor pool is a condition which relates to both the social and the economic realms with important impacts for all of society.

Studies with particular relevance to these concerns are listed in the attached bibliography.

We are faced with several aspects of constraint which seem to be operative. One is the phenomenon known as "math avoidance." Girls, early in the secondary school years, seek to avoid mathematics courses where they are not explicitly required. Some feel that their future roles in life do not call for such knowledge and skills. Some expect not to be in the labor force with this need. Others have been influenced by comments of peers, family, teachers, and others to avoid mathematics because it is too difficult for girls and it is "not for girls to do."

In some situations girls have become convinced that boys have more ability and have better aptitudes for math than girls. Arguments and research reports continue to differ. Nevertheless, for individual girls sex differences may not be a basis for such avoidance.

Attitudes about abilities of girls have moved from occasional, stated "dislikes" and reactions regarding difficulty to an extreme called "math anxiety", this being a state of fear and self-fulfilling disability as regards any aspect of school mathematics. In these cases, emotions result in failures or poor grades in required courses and a total rejection of optional classes thereafter.

A major problem seems to be the social concern which girls express when they are expected to compete with boys in math courses. Since math is acknowledged to be a "male domain", how

could a truly feminine girl compete in their classes, let alone excel?

Giving special focus to the problem, Benbow and Stanley (Science, 2 December 1983) reported on their conclusions from a study of about 40,000 students. The students, under age 13, were part of a talent search conducted among seventh graders in the Middle Atlantic states. Tests taken in mathematics reasoning ability (SAT 1980, 1981, 1982) showed that among gifted students who scored at or over 700, boys outnumbered girls 13 to 1.

Since these seventh graders had relatively little opportunity to study algebra and beyond, the researchers concluded that a sex difference exists whose reasons are yet to be determined. No similar important differences in verbal ability--SAT-V--were found.

Less scientific observers have noted similar conditions in their families, their schools, and in their own personal experiences. The general public as well as those particularly interested in gifted children are faced with perhaps two choices.

The high achieving girls do not achieve as well as high achieving boys in mathematical reasoning, for whatever reason. The situation may possibly be due to environment, to social conditioning, to genetic effects. Schools and families will do what they can to help gifted girls compensate in other areas.

The alternative might be to make greater efforts with groups of gifted girls and to do so especially in mathematics. Thus there is no room, with this alternative, for complacency or for a sense of futility. If the girls are not to lose their

motivation for achieving up to their potential, and if they are not to become a lost resource for society, compensatory practices in mathematics should be considered, planned, and implemented.

At California State University, San Bernardino, it was decided to establish a single sex class, for girls, in mathematics and computer science. The girls would be invited, they would work with a competent woman instructor, and changes in their attitudes would be studied.

The Plan and the Program

At the University a coordinator had been named for new programs in gifted education. A four-course sequence was initiated for a teaching certificate in the education of the gifted and talented. At the same time it was felt that activities with gifted children should be undertaken on the campus. Two courses were advertised for gifted children, grades 5 through 9, in math and computers (girls only), the other for both boys and girls in music and art.

These summer sequences would offer experiences deliberately planned to be unlike those available in the schools: exploratory, non-textbook oriented, non-test, hands-on, with opportunities to create, participate, and observe.

The three-week, 9 a.m. to 1:30 p.m., program was priced at $55 per child, with participants responsible for their own snacks and transportation.

After two months of publicity and responses to inquiries, the planned co-educational program in music and art enrolled four

children. The plan for this activity was dropped.

At the same time, the girls' group in mathematics and computers which was planned for twenty was closed when twenty-three applicants were admitted.

In each case, parents were interviewed (usually on the telephone) and were asked to verify that their child had been identified as gifted in accordance with state criteria and that they were at least two years above grade in math. They were also asked to assure project personnel that their daughters were indeed interested if not enthusiastic about participating in the math-computers program. Verification was provided as to these important elements including school documentation with test scores.

The program was conducted by Dr. Barbara Sirotnik, assistant professor of administration, with degrees in math and statistics. She was also expert in computers and programming. Dr. Sirotnik had not been a teacher of children, but by virtue of her enthusiasm, affection for the children, and her subject-matter expertise, she made an excellent mentor in the program.

The coordinator served as program planner, observer, evaluator for Dr. Sirotnik, coordinator of activities, and contact for the University and the parents. Most sessions of the program were observed by the coordinator who was recognized by the girls as a non-participant in both the math and computer activities.

The girls met each morning in a regular University classroom to consider a topic chosen by Dr. Sirotnik. On occasion they were given work to take home, puzzles and problems to solve and return, and general questions to consider.

Without fail, the girls returned with their "homework"; it was discussed, checked by their mentor, and given individual comments of support and approval. In many cases, when problems were given for home review and solution, girls came back with other, analogous problems, "tougher" ones to challenge the group, and "my way" of getting at solutions.

The observer noted the several ways in which girls examined situations involving probability, logic, algebraic or geometric proofs, and then resolutely announced (and defended) their individual approaches. Often, they asked questions comfortably, seeking clarification, expressing uncertainty, and yielding to another girl's challenge or disagreement. At times, a girl would march up to the blackboard, seize the chalk, and show the group what she meant or <u>why</u> she preferred her "neat" solution to a less elegant one.

As to computers, about ten of the girls had previously worked on micro-computers such as the Apple. Six girls had computers at home. In the University computer facility, enough equipment was available for the novices to take instruction in pairs. For the more experienced girls, work in programming, more advanced and more extensive, was provided. These girls developed programs to organize new games and brain-teasers as well as data banks of their friends' names, addresses, and telephone numbers.

The program of this summer stressed the presence of Dr. Sirotnik as a role model whose effects are still to be fully determined. The purposes of the program were further imple-

mented through a visit to the class by a woman scientist from a nearby aerospace facility. Her discussion of her work, her education, her interests--both professional and personal--were intended elements in the concept of giving the girls appropriate career orientation and information as well as adding another effective role model. In the short duration of the program, it was not possible to bring in other successful women in mathematics and the sciences.

The three-week program for girls only offered a session in mathematics from 9 to 11:30 a.m., then a computer session until 12:40 p.m., followed by supervised swimming in the University pool.

Before the last day of the program, parents had been sent invitations to meet with Dr. Sirotnik and the coordinator for a review session. The invitation stated that their critical comments, their interest in programs for gifted children on the University campus, and their suggestions for further activities were important to continued development of this program in new and similar forms.

On the final, while the girls were swimming, parents representing twenty-one of the girls attended, including several fathers. (For this age group, such involvement was gratifying in itself.) The purposes of the program were discussed with special reference to the girls-only format. There were no negative comments offered, but the following statements were noted:

1. We wish the program had been longer than three weeks.

2. Why didn't the music and art program enroll enough children to succeed?
3. What will the professional staff offer as a follow-up activity for these girls?
4. What about next summer for these girls and for the gifted boys? What about other topics, more topics, and more kids?

Parents offered to help in every possible way with the program in its further development.

It was concluded, by professionals and parents, that this first-ever program for gifted children had indeed been a success. It was agreed that much had been learned about girls and math, especially when boys of this age group are not in the class. And, of course, it was recognized that what had been offered had been enrichment, not advanced placement. It was not known to what extent, if any, attitudes about ability, avoidance, or anxiety with regard to mathematics had been changed over a three-week period.

(The attached questionnaires and accompanying student data are a type of review and summary analysis of the research potential in such programs.)

The fore-going aspects and more remain for follow-up as well as for structured research. The following questions (and certainly others) remain for consideration by school officials, parents, and researchers:

1. Is such a class--for girls only--in violation of the law?

2. Should schools, public and private, offer all-girl classes in math (and in some sciences) with, necessarily, all-boy classes as well as co-ed groupings?
3. How can mathematics be made attractive and important for those girls and boys who are competent though not necessarily like these gifted ones?
4. What can be done about teachers in the elementary grades who are less experienced in math, feel "fearful", and are themselves long-time math-avoiders?
5. What is the most appropriate role for parents of gifted girls to play in approaching such programs?
6. What distinctions should be made between such offerings for gifted girls in the elementary, junior high, and high schools?

11.

PROGRAM PARTICIPANTS Summer 1982.

MATH FOR GIRLS
California State College
San Bernardino, CA

	BIRTHDATE	T. READING	T. LANG.	T. MATH	GRADE	DATE	TEST
1	2-69	12.9	12.9	12.9	7	3-82	CTBS
2	10-70	10.4		10.1	6	1-82	CTBS
3	1-68	12.8	12.9	12.6	7	5-81	BSAT
4	7-71	9.5	9.5	9.5	4	5-81	Stanf.AT
5	11-69	9.8	9.8	9.9	7	11-81	Iowa TBS
6	10-70	11.6		11.9	6	1-82	CTBS
7	8-71	8.2		6.9	5	4-82	CTBS
8	4-68	12.9		12.9	8	1-82	CTBS
9	4-68	12.8	12.9	12.6	7	5-81	Stanf AT
10	11-70	6.9		7.3	6	1-82	CTBS
11	3-71	10.7		11.9	5	4-82	CTBS
12	1-69	12.9		12.9	7	1-82	CTBS
13	6-71	10.4		10.2	5	1-82	CTBS
14	10-70	11.9	11.9	10.6	6		
15	1-68	12.3		9.8	8	1-82	CTBS
16	5-71	11.1		11.1	5	4-82	CTBS
17	10-68	12.9		11.8	8	1-82	CTBS
18	11-71	8.4	9.9	6.9	4		CTBS
19	11-70	12.9		9.6	7	1-82	CTBS
20	12-71				5		SRA (IQ-136)
21	8-69	10.9		9.7	7	1-82	CTBS
22	7-70	97%ile	81%ile	81%ile	6	10-81	IowaTBS
23	10-72	9.9	9.9	7.9	4	-82	CTBS (IQ-149)

MATH FOR GIRLS
July 5, 1982

California State College
San Bernardino

GETTING TO KNOW YOU (Summary) First Day of the Program

1. Experience with computers:

   None: 5
   Slight: 3 (in school)
   Some: 14 (special class, friends' homes)
   One at home: 6

2. Most recent grade in math: A 11 B 6 C 3
   No report: 3

3. Study of math: Regular class: 18 Special class: 5
   On my own: 5 Parents help: 8
   No report: 3

4. Parents' schooling (highest level achieved):

	Father	Mother
Doctorate	3	2
Master's	6	2
College, 4 years or more	5	10
Fewer than 4 years of College	2	3
High school graduate	1	-
No report	5	4

5. Perceived math ability of parent by child:

	Father	Mother
Above average	16	8
Average	5	12
Below average	1	1
No report	1	2

6. Perceived math ability of siblings by child ("very good in math"):
   Older sister: 8 Older brother: 7
   Younger sister: 5 Younger brother: 3

7. Parents' work:

	Father	Mother
Science-related	4	3
Education	4	6
Business	4	4
Skilled/mechanical	5	5
Homemaker	-	1
Other (lawyer, actor, minister, musician, psychologist)	4	1

Math for Girls Your name _____ 13.

YOUR OPINION, PLEASE! JULY 14, 1982 N=22 Mid-session

At this time, we are halfway in the summer GATE program for girls. We would like to have your opinions and comments. Feel free to write on the back of this page if you need more room.

1. What I expected when I first decided to join the Summer GATE program: (activities, new experiences, new things to learn, etc.)
   a. Computers, more: 7
   b. Learn new things: 5
   c. Learn to like math: 3
   d. More advanced math: 4
   e. Fun: 4
   f. Older girls in the group: 1
   g. Thought it would be like school, it is not.: 1

2. The activities I have found most interesting so far are:
   a. Computers, general: 12
   b. Math, logic patterns, games: 8
   c. Programming: 10
   d. Swimming: 8
   e. Binary system: 3
   f. All activities: 1
   g. "Not having fun in math": 1

3. The activities I am learning a lot from are:
   a. Programming: 9
   b. Computers, general: 8
   c. Math: 9
   d. Logic games, probability, binary system: 9

4. I have some new feelings and attitudes about being in a class of girls only, about doing new things in math, about computers, etc.: Please comment:
   a. All girl group: 12
   b. All girl group, want boys: 3
   c. More advanced math wanted: 2
   d. Enjoy class and people: 2
   e. "Yes, I really want to learn": 1

5. I hope we can do (what have we not done):
   a. More with computers, general: 5
   b. Advanced programming: 6
   c. More work in math: 4
   d. Statistics: 1
   e. More swimming: 2
   f. All I expected, not sure, blank: 5

6. Things in the program (time, location, materials, etc.) that I would like to see changed are:
   a. More computers, less math: 5
   b. Uses of time (not specific): 4
   c. No change wanted and blank: 6
   d. More computers: 3
   e. More swimming: 1. Skip swimming: 1
   f. More weeks in the program: 1

7. Other comments, please:
   a. About the program, positive: 17. "Special compliments for B (mentor): 3
      "Thanks!": 2
      "Glad my mom made me come": 1
      "Love this class": 2
      "I like the class, with its bad points": 1

Read the following sentences. They will help us to get your opinions and thoughts about math. As you read each sentence, you will know if you agree or disagree. CIRCLE SA if you Strongly Agree; A if you Agree; D if you Disagree; SD if you Strongly Disagree. There are no correct answers.

		JULY 6				JULY 23			
		SA	A	D	SD	SA	A	D	SD
1.	Anyone can learn math	5	17	1	-	16	6	1	-
2.	My parents expect me to do well in math	11	10	2	-	9	12	2	-
3.	Knowing math will help me earn a living	13	9	-	-	15	8	-	-
4.	I would trust a woman just as much as I would trust a man to figure out important calculations	19	4	-	-	17	6	-	-
5.	My friends don't think of me as a math whiz	3	12	5	3	1	13	6	3
6.	I get scared when I open my math book and see a page full of problems	2	2	16	3	1	5	11	6
7.	Math has been my worst subject	3	3	6	11	2	4	3	14
8.	It's hard to believe a female could be a genius in math	1	-	4	17	-	-	2	21
9.	Mathematics is a necessary and worthwhile subject	9	12	-	2	14	7	-	-
10.	My parents do not encourage me in my study of math	-	2	9	12	1	1	6	14
11.	Math is fairly easy for me	5	13	4	-	7	14	2	-
12.	I expect to have little use for math when I leave school.	1	3	11	8	4	1	7	11
13.	I don't think I could do advanced math	1	1	12	9	1	2	10	10
14.	Boys tend to do better in math than girls	-	1	7	15	-	-	4	19
15.	When a math problem arises that I can't immediately solve, I stick with it until I have the answer	3	16	3	1	1	16	5	1
16.	My teachers encourage me in my study of math	5	16	2	-	9	12	1	-

2.

17.	Mathematics can be exciting	8	11	4	-	8	14	1	-
18.	Males are not naturally better than females in math	7	9	3	4	6	10	1	5
19.	Very few people can learn math.	-	-	7	14	1	-	7	13
20.	My teachers do not expect me to do well in math	-	-	11	11	-	-	9	14
21.	Girls can do just as well as boys in math	15	6	2	-	19	4	-	-
22.	It wouldn't bother me at all to take more math courses	3	16	4	-	8	12	2	1
23.	Math involves a lot of learning by heart	5	15	2	-	3	16	1	2
24.	When a woman has to solve a math problem, it is appropriate to ask a man for help	-	2	6	15	-	1	4	17
25.	I am sure I could do advanced work in mathematics	5	12	3	3	6	13	1	2
26.	Girls who enjoy studying math are a bit peculiar	-	1	7	15	-	2	6	15
27.	I'm not the type to do well in math	1	2	13	7	-	3	9	10
28.	My teachers think I can do well in math	6	17	-	-	8	15	-	-
29.	Outside of science and engineering, there is little need for math in most jobs	-	2	10	11	2	-	5	15
30.	Studying math is just as appropriate for men as for women	10	13	-	-	16	5	1	-
31.	I would expect a woman mathematician to be a masculine type of person	-	1	9	11	-	-	15	8
32.	Math doesn't worry me at all	7	8	7	1	5	14	4	-

Adapted from Brush, L., Encouraging Girls in Mathematics, 1980.

Math for Girls A Summer Gate Program Your name FINAL SURVEY- July 23, 1982

YOUR OPINIONS AGAIN, PLEASE! With the ending of the Summer Program for GATE Girls, we would like to have your opinions and comments. They will help us to make plans for the future and to invite you to more activities, if you are interested. Please answer the following questions as fully as possible. Use the back of the page if you need more room.

1. The activities that I think were most important for my future education and career were:

   Computers: 14 Probability: 5 Everything: 1

   Mathematics: 12 Logic: 5 Blank: 1

   Programming: 8 Binary systems: 5

2. My feelings about being in a class of girls only are:

   Good: 9 Boring without "guys": 3

   More fun with girls only: 7 Less competition: 2

   More comfortable: 5 Less challenging: 2 Blank: 1

3. This Summer Program met my expectations:

   a. 13 to a great extent. c. 0 very little.

   b. 10 to some extent d. 0 not at all.

   Please give reasons for the answer you chose:

   It was fun: 8 Learned computers: 3

   Didn't learn as much in math as expected: 5 It was exciting: 2

   Learned a lot: 6 No reason given: 3

4. If a Math for Girls Program is to be planned for next summer, I have the following suggestions:

   Longer time for the program: 4 Reduce age range: 3

   Do the same good job next year: 4 More computers: 2

   Math and then other subjects: 3 Less math: 2 None given: 2

5. My interests in having more activities for me at Cal State for Gate Girls would be:

   Computers: 4 Drama: 3 Photography: 2 Science: 2 Blank: 6

   Art: 4 Math: 2 Ceramics: 2 English: 2

6. What are your career plans? 1st Choice Doctor: 5 Lawyer: 2 Teacher: 2 Blank: 3

   2nd Choice Computer programmer: 5 Blank: 5

   3rd Choice Lawyer: 2 Actor: 2 Blank: 7

7. Other comments, please, about your summer in this program:

   Thoroughly enjoyable: 16

   Worthwhile: 3

   Want to come next year: 3

   Some of the work was hard: 1 (and numerous other single comments, all positive.)

Math for Girls Page 2 Your name FINAL SURVEY July 23, 1982

Please answer the following questions about math and computers:

As regards math:

1. I feel (*15* more 0 less *8* as) comfortable about myself and math than when I started this Program. (Underline the word for your answer.)
2. I believe I learned (some *23* new things no more than at my *0* school very little *0*) about math in this Program.
3. I believe now that I could go into a career that is based on math: *12* more *11* the same less. (Remember our visitor from TRW and Barbara!)
4. I expect I will take courses in math including (underline the ones you will plan to take): plane geometry-*15* algebra-*19* intermediate algebra-*12* advanced algebra-*16* trigonemetry-*13* calculus-*14* *statistics-1* *physics-2* _____ _____ (fill in).
5. I would like to know more about:

   14 careers based on math.

   12 how to do better in math.

   3 famous women scientists and mathematicians.

   5 the history of math.

   ___ Other *advanced math-1*

6. Your comments about math, based on this summer's experiences:

   Had fun-11

   Helped me to like math now!-4

   Learned many new things-3

   Liked the challenges-2

   LIked probability-2

   Sometimes bored with the work-2

Math for Girls Page 3 Your name *FINAL SURVEY-July 23, 1982*

As regards computers:

1. I feel (more *23* less *0* as *0*) comfortable in making computer programs than at the start of the Program. (Underline the word for your answer.)

2. I feel I understand the ideas behind computers (more than *19* less than *0* as much as *4*) at the start of this Program.

3. I am (more *23* less *0* as much *3*) interested in going into advanced computer studies than at the start of this Program.

4. (Please underline the words you would choose):
In general, I feel my experiences with computers and programming has been enjoyable-*21* boring-*1* exciting-*15* helpful-*17* wasteful-*0* *good experience-2* *fun-2* (other).

5. As regards computers, I would like to know more about the following:
Programming sounds and graphics-8 *Blank-3*

Harder programs-8

Other languages-2

How to save programs-2

6. Other comments, please, about computers and programming, based on this summer's experiences:

Loved it-10

I was taught everything I wanted to know-7

Glad I got into the class-4

More courses wanted-3

I became interested in a future career in computers-3

Now I can work our family's computer-2

Blank-2

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